Chapter 8
Noise and Vibration

8.1 Affected Environment

This section describes the affected environment related to noise and vibration for the dam and reservoir modifications proposed under the Shasta Lake Water Resources Investigation.

8.1.1 Acoustic Fundamentals

Noise is generally defined as sound that is loud, disagreeable, or unexpected. Sound, as described in more detail below, is an audible vibration of an elastic medium.

Sound Properties

A sound wave is introduced into a medium (e.g., air) by a vibrating object. The vibrating object (e.g., vocal cords, the string and sound board of a guitar, or the diaphragm of a radio speaker) is the source of the disturbance that sets the medium to vibrate and then propagates through the medium. Regardless of the type of source creating the sound wave, the particles of the medium through which the sound moves are vibrating in a back-and-forth motion at a given frequency, tone, or pitch. The frequency of a wave refers to how often the particles vibrate when a wave passes through the medium. Wave frequency is measured as the number of complete back-and-forth vibrations of a particle per unit of time. If a particle of air undergoes 1,000 longitudinal vibrations in 2 seconds, then the frequency of the wave would be 500 vibrations per second. A commonly used unit for frequency is Hertz (Hz).

Each particle vibrates as a result of the motion of its nearest neighbor. For example, the first particle of the medium begins vibrating at 500 Hz and sets the second particle of the medium into motion at the same frequency (500 Hz). The second particle begins vibrating at 500 Hz and thus sets the third particle into motion at 500 Hz. The process continues throughout the medium; hence each particle vibrates at the same frequency, which is the frequency of the original source. Subsequently, a guitar string vibrating at 500 Hz will set the air particles in the room vibrating at the same frequency (500 Hz), which carries a sound signal to the ear of a listener that is detected as a 500-Hz sound wave.

The back-and-forth vibration motion of the particles of the medium would not be the only observable phenomenon occurring at a given frequency. Because a sound wave is a pressure wave, a detector could be used to detect oscillations in pressure from high to low and back to high pressure. As the compression (high-pressure points) and rarefaction (low-pressure points) disturbances move through the medium, they would reach the detector at a given frequency. For example, a compression would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Similarly, a rarefaction would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Thus, the frequency of a sound wave refers not only to the number of back-and-forth vibrations of the particles per unit of time but also to the number of compression or rarefaction disturbances that pass a given point per unit of time. A detector could be used to detect the frequency of these pressure oscillations over a given period of time. The period of the sound wave can be found by measuring the time between successive compressions or the time between successive rarefactions. The frequency is simply the reciprocal of the period; thus an inverse relationship exists so that as frequency increases, the period decreases, and vice versa.

A wave is a disturbance through some medium (e.g., air, water, space) that typically transfers energy. Waves travel and transfer energy from one point to another, often with little or no permanent displacement of the particles of the medium. For example, in an ocean wave, the seawater appears to be move along the path of the wave. However, the water particles themselves are nearly stationary—it is the energy transferred through those particles (the wave) causing displacement that makes it appear that the water itself is moving.

In the case of sound (and noise), the “wave” is a vibration or disturbance moving through air particles and, at a certain range of frequencies, is audible to the human ear. The amount of energy carried by a wave is related to the amplitude (loudness) of the wave. A high-energy wave is characterized by high amplitude; a low-energy wave is characterized by low amplitude. The amplitude of a wave refers to the maximum amount of displacement of a particle from its rest position. The energy transported by a wave is directly proportional to the square of the amplitude of the wave. This means that a doubling of the amplitude of a wave indicates a quadrupling of the energy transported by the wave.

Sound and the Human Ear

Because of the ability of the human ear to detect a wide range of sound-pressure fluctuations, sound-pressure levels are expressed in logarithmic units called decibels (dB). The sound-pressure level in decibels is calculated by taking the log of the ratio between the actual sound pressure and the reference sound pressure squared. The reference sound pressure is considered the absolute hearing threshold (Caltrans 1998). Use of this logarithmic scale reveals that the total sound from two individual sources of 65 A-weighted decibels (dBA) each (see explanation of the A-weighting scale below) is 68 dBA, not 130 dBA; that is, doubling the source strength increases the sound pressure by 3 dBA.

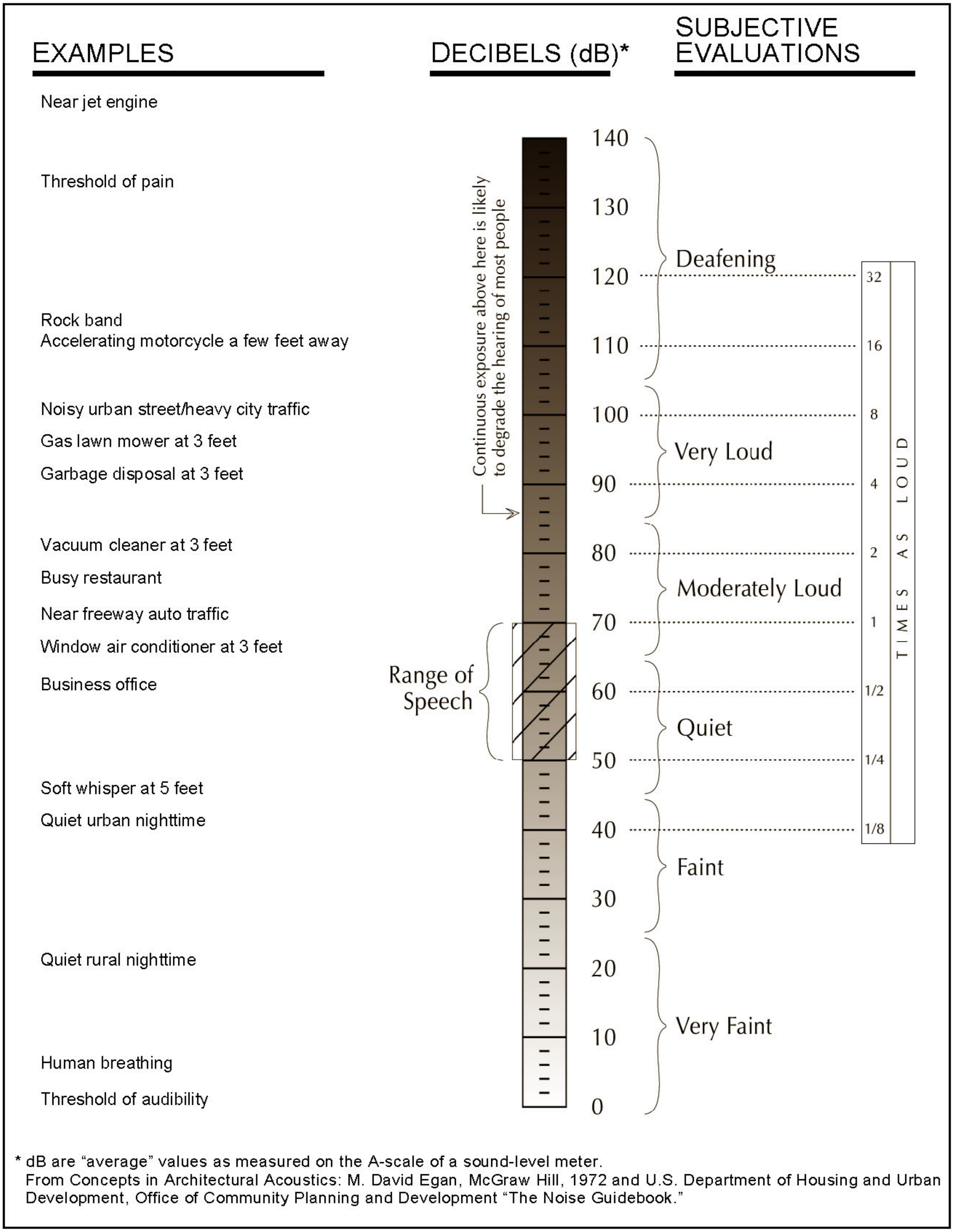
The human ear is sensitive to frequencies from 20 Hz to 20,000 Hz (the audible range) and can detect the vibration amplitudes that are comparable in size to a hydrogen atom (EPA 1974). When damaged by noise, the ear is typically affected at the 4,000-Hz frequency first; therefore, this can be considered the most noise-sensitive frequency. The averaged frequencies of 500 Hz, 1,000 Hz, and 2,000 Hz have traditionally been employed in hearing conservation criteria because of their importance to the hearing of speech sounds (ASA 1997).

The human ear is not equally sensitive to all sound frequencies, depending on the amplitude of the sound; therefore, a specific frequency-dependent rating scale was devised to relate noise to human sensitivity. This called the weighting scale or function. The A-weighting scale is the most commonly used and is noted as A-weighted dB, dB(A), or dBA. The dBA scale discriminates against frequencies in a manner approximating the sensitivity of the human ear when a source is at 50 dB. The basis for compensation is a comparison of the “loudness” of tones played one at a time with a reference tone producing 50 dB. This dBA scale has been chosen by most authorities for the purpose of regulating environmental noise. Typical indoor and outdoor noise levels are presented on Figure 8-1.

With respect to how humans perceive increases in noise levels, for pure tones or some broadband tones, a 1-dBA increase is imperceptible, a 3-dBA increase is barely perceptible, a 6-dBA increase is clearly perceptible, and a 10-dBA increase is subjectively perceived as approximately twice as loud (Egan 1988). For this reason, an increase of 3 dBA or more is generally considered a degradation of the existing noise environment for this type of source. For more complex sources, that is, where the tones differ substantially between sources, such as for the sound of a heavy truck versus a new car or a kitchen blender, the ear perceives differences much more quickly.

Sound Propagation

As sound (noise) propagates from the source to the receptor, the attenuation, or manner of noise reduction in relation to distance, depends on surface characteristics, atmospheric conditions, and the presence of physical barriers. The inverse-square law describes the attenuation when sound travels from a point source such as an air-conditioning unit to the receptor. Sound travels uniformly outward from a point source in a spherical pattern with an attenuation rate of 6 dBA per doubling of distance (dBA/DD). However, from a line source, such as a long line of traffic on a freeway, sound travels uniformly outward in a cylindrical pattern with an attenuation rate of 3 dBA/DD. The surface characteristics between the source and the receptor may result in additional sound absorption and/or reflection. Atmospheric conditions such as wind speed, temperature, and humidity may affect noise levels. Furthermore, the presence of a barrier between the source and the receptor may also attenuate noise levels. The actual amount of attenuation depends on the size of the barrier and the frequency of the noise. A noise barrier may be any natural or human-made feature such as a hill, building, wall, or berm (Caltrans 1998).



Source: Data compiled by AECOM in 2011

Figure 8-1. Typical Noise Levels

Noise Descriptors

The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise are defined below (Caltrans 1998; Lipscomb and Taylor 1978):

- **L_{max} (maximum noise level) –** The maximum noise level during a specific period of time. The L_{max} may also be referred to as the "highest (noise) level."
- **L_{min} (minimum noise level) –** The minimum noise level during a specific period of time.
- **L_x (statistical descriptor) –** The noise level exceeded X percent of a specific period of time.
- **L_{eq} (equivalent noise level) –** The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value is calculated, which is then converted back to dBA to determine the L_{eq}.
- **L_{dn} (day-night noise level) –** The 24-hour L_{eq} with a 10-dBA "penalty" for the noise-sensitive hours between 10 p.m. and 7 a.m. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.
- **CNEL (community noise equivalent level) –** A noise level similar to the L_{dn} described above, but with an additional 5-dBA "penalty" for the noise-sensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. If the same 24-hour noise data are used, the CNEL is typically approximately 0.5 dBA higher than the L_{dn}.
- **SEL (single-event (impulsive) noise level) –** A receiver's cumulative noise exposure from a single impulsive-noise event, which is defined as an acoustical event of short duration and which involves a change in sound pressure above some reference value.

Negative Effects of Noise on Humans

Negative effects of noise exposure include physical damage to the human auditory system, speech interference, sleep interference, activity interference, and disease. Exposure to noise may result in physical damage to the auditory system, which may lead to gradual or traumatic hearing loss. Gradual hearing loss is caused by sustained exposure to moderately high noise levels over a period of time; traumatic hearing loss is caused by sudden exposure to extremely high noise levels over a short period. However, gradual and traumatic hearing loss both may result in permanent hearing damage. In addition, noise may interfere with or interrupt sleep, relaxation, recreation, and communication. Although most interference may be classified as annoying, the inability to hear a warning signal may be considered dangerous. Noise may also be a contributor to diseases associated with stress, such as hypertension, anxiety, and heart disease. The degree to which noise contributes to such diseases depends on the frequency, bandwidth, and level of the noise, and the exposure time (Caltrans 1998).

Vibration Fundamentals

Vibration is sound radiated through the ground. The rumbling sound caused by the vibration of room surfaces is called groundborne noise. Sources of groundborne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, and landslides) and human-made causes (e.g., explosions, machinery, traffic, trains, and construction equipment). Vibration sources may be continuous, such as factory machinery, or transient, such as explosions. As is the case with airborne sound, groundborne vibrations may be described by amplitude and frequency.

Vibration amplitudes are usually expressed in peak particle velocity (PPV) or root mean squared (RMS), as in RMS vibration velocity. The PPV and RMS velocity are normally described in inches per second (in/sec). PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is often used in monitoring of blasting vibration because it is related to the stresses that are experienced by buildings (FTA 2006; Caltrans 2002a).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a 1-second period. As with airborne sound, the RMS velocity is often expressed in decibel notation, expressed as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA 2006).

The background vibration-velocity level in residential areas is usually approximately 50 VdB. Groundborne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels (FTA 2006).

Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Construction activities can generate groundborne vibrations, which can pose a risk to nearby structures. Constant or transient vibrations can weaken structures, crack facades, and disturb occupants (FTA 2006).

Construction vibrations can be either transient, random, or continuous. Transient construction vibrations are generated by blasting, impact pile driving, and wrecking balls. Continuous vibrations result from vibratory pile drivers, large pumps, and compressors. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment. Table 8-1 describes the general human response to different levels of groundborne vibration-velocity levels.

Table 8-1. Human Response to Different Levels of Groundborne Noise and Vibration

Vibration-Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

Source: FTA 2006

Key:
VdB = vibration decibels

8.1.2 Existing Noise Sources and Levels

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Existing sources of noise and vibration in the primary study area associated with roadway traffic and aircraft noise are outlined below. Noise is also generated by watercraft on Shasta Lake and stationary noise sources such as mechanical equipment at the existing dam facility. Additional sites that would be affected by the project are existing bridges, roads, and structures that would be inundated with implementation of the proposed dam rise and would need to be modified, demolished, or reconstructed. Sensitive receptors in these areas consist of residences, transient lodging, and recreational facilities.

Roadway Traffic Interstate 5 (I-5) and State Routes 36, 44, 151, 273, and 299 contribute the majority of roadway noise in the greater Shasta area. The Federal Highway Administration's Highway Traffic Noise Prediction Model was used to predict existing traffic noise levels for these routes. Table 8-2 shows existing average daily traffic volumes for Shasta County's major roadways, modeled vehicle distribution characteristics, and the modeled distance from the roadway centerline to the various noise-level contours for each affected roadway segment in the study area under existing conditions. The traffic noise levels shown in the table assume no shielding or reflection from structures or topography. Actual noise levels would vary from day to day.

Railway Traffic Shasta County is served by the Union Pacific Railroad single-track main line, which travels north/south through the primary study area, paralleling I-5. (The McCloud Railway Company, a single-track short line, runs from McCloud to Burney, but because its activity is limited, noise measurements were not conducted for this line.) Noise measurements were conducted at two sites near Redding and Cottonwood for the *Shasta County General Plan* Noise Element. Table 8-3 presents noise levels associated with railroad noise in the Shasta Lake area.

Aircraft The three existing airports in the primary study area are described below.

Redding Municipal Airport In 2003, there were approximately 81,000 total aircraft operations at Redding Municipal Airport. As shown in the background report for the *Shasta County General Plan* Noise Element, the 65-dB CNEL contour is confined primarily to the airport property. The 60-dB CNEL contour extends outside of the property, but does not encroach on existing residential uses. According to the *Redding Municipal Airport Master Plan*, aviation growth at the airport will affect the surrounding area. The total number of aircraft operations is estimated to increase to 162,400 by 2015.

Shingletown Airport In 2003, there were zero aircraft operations at Shingletown Airport. Because of trees in the runway protection zone and deterioration of the tarmac, the operating permit was suspended indefinitely by the State in 2002. No future operations are planned for this facility at this time.

Fall River Mills Airport In 2001, there were approximately 6,000 total aircraft operations at Fall River Mills Airport. Based on the *Environmental Assessment for the Fall River Mills Airport Layout Plan* (April 2003), the existing 65-dB CNEL contour is contained within the existing airport boundary. Aviation growth at Fall River Mills Airport can also affect the area surrounding the airport. The number of aircraft operations is expected to increase to 15,000 by 2021. The future (2021) 65-dB CNEL contour is confined to Public Facility and Agriculture lands. The 60-dB CNEL contour also encompasses Urban Residential lands.

Table 8-2. Summary of Modeled Existing Traffic Noise Levels (Year 2006)

Roadway Segment	Modeling Assumptions					Distance (feet) from Roadway Edge to CNEL/L_{dn} (dBA)[1]				CNEL/L_{dn} (dBA) from Roadway Edge
	Average Daily Traffic Volume	Speed (mph)	Grade (%)	Traffic Distribution Percentages (%)		70 CNEL	65 CNEL	60 CNEL	55 CNEL	50 Feet
				Auto/Medium Truck/Heavy Truck	Day/ Evening/ Night					
SR 36, north of Red Bluff	12,000	45	0	79/9/12	79/11/10	64	138	298	641	72
SR 44, junction with I-5	51,000	65	0	81/9/10	79/11/10	235	507	1,093	2354	80
SR 151, Shasta Lake	5,500	45	0	81/9/10	79/11/10	36	77	165	356	68
SR 273, Redding	23,800	35	0	81/9/10	79/11/10	74	160	345	742	73
SR 299, Redding	19,900	35	0	81/9/10	79/11/10	66	142	306	659	72
I-5, Bridgebay	27,500	70	0	81/9/10	79/11/10	171	368	792	1,706	78
I-5, Shasta Lake	37,000	70	0	81/9/10	79/11/10	208	448	965	2,080	79
I-5, Redding	67,000	70	0	81/9/10	79/11/10	309	666	1,434	3,090	82
I-5, Anderson	50,000	70	0	81/9/10	79/11/10	254	548	1,180	2,542	81
I-5, Cottonwood	46,500	70	0	81/9/10	79/11/10	242	522	1,124	2,422	80
I-5, Red Bluff	40,500	70	0	79/9/12	79/11/10	231	498	1,073	2,313	80

Source: Average daily traffic volumes from CalTrans (2006). Modeling performed by EDAW (now AECOM) in 2007

Key:
CalTrans = California Department of Transportation
CNEL = community noise equivalent level
dBA = A-weighted decibels
I-5 = Interstate 5
L_{dn} = day-night noise level
mph = miles per hour
SR = State Route

Table 8-3. Approximate Distance to Union Pacific Railroad Noise Contours

L_{dn}, Based on Distance from Railroad Tracks				Distance to L_{dn} Contour (feet)			
At 50 Feet		At 100 Feet		60 dB		65 dB	
Existing	Future	Existing	Future	Existing	Future	Existing	Future
South of Bonnyview Road				**South of Bonnyview Road**			
69.5 dB	70.8 dB	65.0 dB	66.3 dB	215	262	100	122
Cottonwood				**Cottonwood**			
76.0 dB	77.3 dB	71.5 dB	72.8 dB	580	711	269	330

Source: Shasta County 2004
Key:
dB = decibel
L_{dn} = day-night noise level

Benton Airpark In 2009, there were approximately 35,000 total aircraft operations at Benton Airpark. Based on the *Benton Airpark Master Plan* (March 2005), the existing 65-dB CNEL contour is contained within the existing airport boundary. Aviation growth at Benton Airpark can also affect the area surrounding the airport. The number of aircraft operations is expected to increase to 38,000 by 2021. The future (2021) 65-dB CNEL contour is confined to airport property and vacant land.

Other Aircraft Activities In addition to the aircraft facilities listed above, helipads from medical facilities in Redding are also in use. Usage of these helipads would be reserved for emergencies and would be intermittent in comparison to usage by full-time facilities such as the Benton Airpark. In the fire season, aircraft operated by the California Department of Forestry and Fire Protection use Shasta Lake as a source of water for fighting wildfires. Fire helicopters and tankers use the lake as needed during emergencies. Because firefighting is intermittent, no consistent noise levels would result from firefighting operations.

Fixed Noise Sources Industrial, light industrial, commercial, and public service facilities that could produce objectionable noise levels at nearby noise-sensitive uses are dispersed throughout the primary study area. Among these fixed noise sources are lumber mills, auto maintenance shops, car washes, loading docks, recycling centers, electricity generating stations, landfills, and athletic fields.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Noise sources within the extended study area would be similar to the general descriptions provided for the primary study area.

8.1.3 Existing Noise-Sensitive Land Uses

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Noise-sensitive land uses (sensitive receptors) are uses where exposure to noise would result in adverse effects and uses where quiet is essential. Residential dwellings are of primary concern. Other noise-sensitive land uses are schools, hospitals, convalescent facilities, parks, hotels, places of worship, and libraries. No sensitive land uses are immediately adjacent to (within 0.5 mile of) the dam. Sensitive land uses in the proximity of the dam raise site would be the vacant on site residence at the fish hatchery approximately one-half mile downstream. The nearest occupied residence is the horse camp located approximately 7,000 feet downstream; residents on Lake Boulevard are located approximately 4,500 feet east. Other sensitive receptors would include any residences within one-half mile of other construction work being done as a result of the dam raise. Bridge construction would occur at Charlie Creek, Doney Creek, McCloud River, Pit River, and other Union Pacific Railroad bridges. Major road construction would occur on Lakeshore Drive, in the Turntable Bay Area, on Gillman Road, in Jones Valley and the Silverthorne Area, and on Salt Creek Road. The nearest school to construction activities would be the Smithson School in Lakehead (approximately 500 feet); the nearest place of worship would be Canyon Community Church also in Lakehead (approximately 800 feet).

Lower Sacramento River and Delta and CVP/SWP Service Areas

Noise receptors within the extended study area would be similar to those generally described above for the primary study area.

8.2 Regulatory Framework

8.2.1 Federal

No Federal plans, policies, regulations, or laws related to noise are applicable to the project. The environmental review of Federal projects generally defers to State, county, or other local guidelines.

To address the human response to groundborne vibration, the Federal Transit Administration (FTA) of the U.S. Department of Transportation has set forth guidelines for maximum-acceptable vibration criteria for different types of land uses. These criteria include 65 VdB for land uses where low ambient vibration is essential for interior operations (e.g., hospitals, high-tech manufacturing, and laboratory facilities), 80 VdB for residential uses and buildings where people normally sleep, and 83 VdB for institutional land uses with primarily daytime operations (e.g., schools, churches, clinics, and offices) (FTA 2006).

Standards have also been established to address the potential for groundborne vibration to cause structural damage to buildings. These standards were developed by the Committee of Hearing, Bio Acoustics, and Bio Mechanics at the request of the U.S. Environmental Protection Agency (FTA 2006). For fragile structures, Committee of Hearing, Bio Acoustics, and Bio Mechanics recommends a maximum limit of 0.25 in/sec PPV (FTA 2006).

8.2.2 State

Governor's Office of Planning and Research

The Governor's Office of Planning and Research published the *State of California General Plan Guidelines* (OPR 2003), which provides guidance for the acceptability of projects within specific L_{dn} contours. Table 8-4 summarizes acceptable and unacceptable community noise exposure limits for various land use categories.

Generally, residential uses (e.g., mobile homes) are considered to be acceptable in areas where exterior noise levels do not exceed 60 dBA L_{dn}. Residential uses are normally unacceptable in areas exceeding 70 dBA L_{dn} and conditionally acceptable within 55–70 dBA L_{dn}. Schools are normally acceptable in areas up to 70 dBA L_{dn} and normally unacceptable in areas exceeding 70 dBA L_{dn}. Commercial uses are normally acceptable in areas up to 70 dBA CNEL. Between 67.5 and 77.5 dBA L_{dn}, commercial uses are conditionally acceptable, depending on the noise insulation features and the noise reduction requirements. With respect to water recreation uses, exterior noise levels that do not exceed 75 dBA CNEL/L_{dn} are considered normally acceptable, levels between 70 and 80 dBA CNEL/L_{dn} are normally unacceptable, and levels that exceed 80 dBA CNEL/L_{dn} are clearly unacceptable. The guidelines also present adjustment factors that may be used to arrive at noise-acceptability standards that reflect the noise-control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise issues.

California Department of Transportation

For the protection of fragile, historic, and residential structures, the California Department of Transportation (Caltrans) recommends a threshold of 0.2 in/sec PPV for normal residential buildings and 0.08 in/sec PPV for old or historically significant structures (Caltrans 2002a). These standards are more stringent than the Federal standard established by Committee of Hearing, Bio Acoustics, and Bio Mechanics, presented above.

Table 8-4. State Noise-Compatibility Guidelines by Land-Use Category

Land-Use Category	Community Noise Exposure (CNEL/L_{dn}, dBA)			
	Normally Acceptable [a]	Conditionally Acceptable [b]	Normally Unacceptable [c]	Clearly Unacceptable [d]
Residential – Low-Density Single-Family, Duplexes, Mobile Homes	< 60	55–70	70–75	75+
Residential – Multifamily	< 65	60–70	70–75	75+
Transient Lodging – Motels, Hotels	< 65	60–70	70–80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	< 70	60–70	70–80	80+
Auditoriums, Concert Halls, Amphitheaters		< 70	65+	
Sports Arenas, Outdoor Spectator Sports		< 75	70+	
Playgrounds, Neighborhood Parks	< 70		68–75	72.5+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	< 75		70–80	80+
Office Buildings, Businesses, Commercial and Professional	< 70	68–78	75+	
Industrial, Manufacturing, Utilities, Agriculture	< 75	70–80	75+	

Source: OPR 2003

Notes:

[a] Specified land use is satisfactory, based on the assumption that any buildings involved are of normal conventional construction, without any special noise-insulation requirements.

[b] New construction or development should be undertaken only after a detailed analysis of the noise-reduction requirements is made and needed noise-insulation features are included in the design. Conventional construction, but with closed windows and fresh-air supply systems or air conditioning, will normally suffice.

[c] New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise-reduction requirements must be made and needed noise-insulation features included in the design. Outdoor areas must be shielded.

[d] New construction or development should generally not be undertaken.

Key:

CNEL = community noise equivalent level

dBA = A-weighted decibels

L_{dn} = day-night noise level

8.2.3 Regional and Local

Shasta County

Shasta County General Plan Noise Element The Noise Element of the *Shasta County General Plan* includes goals, standards, and policies designed to ensure that county residents are not subjected to noise beyond acceptable levels (Shasta County 2004). Policies that may be applicable to the project include the following:

- **Policy N-b –** Noise likely to be created by a proposed non-transportation land use shall be mitigated so as not to exceed the noise level standards of Table 8-5 as measured immediately within the property line of adjacent lands designated as noise-sensitive.

- **Policy N-c –** Where proposed non-residential land uses are likely to produce noise levels exceeding the performance standards of Table 8-5 upon existing or planned noise-sensitive uses, an acoustical analysis shall be required as part of the environmental review process so that appropriate noise mitigation may be included in the project design. The requirements for the content of an acoustical analysis are given by Table 8-5.

- **Policy N-d –** The feasibility of proposed projects with respect to existing and future transportation noise levels shall be evaluated by comparison to Tables 8-5 and 8-6.

- **Policy N-f –** Noise created by new transportation sources shall be mitigated to satisfy the levels specified in Table 8-5 at outdoor activity areas and/or interior spaces of existing noise-sensitive land uses. Transportation noise shall be compared with existing and projected noise levels.

- **Policy N-g –** Existing noise-sensitive uses may be exposed to increased noise levels due to future roadway improvement projects as a result of increased traffic capacity and volumes and increases in travel speeds. In these instances, it may not be practical to reduce increased traffic noise levels consistent with those contained in Table 8-5. Therefore, as an alternative, the following criteria may be used as a test of significance for increases in the ambient outdoor activity areas of the noise level of noise-sensitive uses created as a result of a new roadway improvement project:

Table 8-5. Noise Level Performance Standards for New Projects Affected by or Including Nontransportation Sources

<table>
<tr><th>Noise Level Descriptor</th><th colspan="2">Daytime
(7 a.m. to 10 p.m.)</th><th>Nighttime
(10 p.m. to 7 a.m.)</th></tr>
<tr><td>Hourly L_{eq}, dB</td><td colspan="2">55</td><td>50</td></tr>
<tr><td colspan="4">The noise levels specified above shall be lowered by 5 dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

The County can impose noise level standards which are more restrictive than those specified above based upon determination of existing low ambient noise levels.

In rural areas where large lots exist, the exterior noise level standard shall be applied at a point 100 feet away from the residence.

Industrial, light industrial, commercial, and public service facilities which have the potential for producing objectionable noise levels at nearby noise-sensitive uses are dispersed throughout the County. Fixed-noise sources which are typically of concern include, but are not limited to, the following:</td></tr>
<tr><td colspan="2">HVAC Systems
Cooling Towers/Evaporative Condensers
Pump Stations
Lift Stations
Emergency Generators
Boilers
Steam Valves
Steam Turbines
Generators
Fans
Air Compressors</td><td colspan="2">Heavy Equipment
Conveyor Systems
Transformers
Pile Drivers
Grinders
Drill Rigs
Gas or Diesel Motors
Welders
Cutting Equipment
Outdoor Speakers
Blowers</td></tr>
</table>

Source: Shasta County 2004

Notes:

The types of uses which may typically produce the noise sources described above include, but are not limited to: industrial facilities including lumber mills, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, public works projects, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, and athletic fields.

For the purposes of the Noise Element, transportation noise sources are defined as traffic on public roadways, railroad line operations, and aircraft in flight. Control of noise from these sources is preempted by Federal and State regulations. Other noise sources are presumed to be subject to local regulations, such as a noise control ordinance. Non-transportation noise sources may include industrial operations, outdoor recreation facilities, heating, ventilation, and air conditioning units, loading docks, etc.

Key:

County = Shasta County

dB = decibels

HVAC = heating, ventilation, and air conditioning

L_{eq} = equivalent noise level

Table 8-6. Requirements for an Acoustical Analysis

An acoustical analysis prepared pursuant to the Noise Element shall:	
A.	Be the financial responsibility of the applicant.
B.	Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics.
C.	Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions and the predominant noise sources.
D.	Estimate existing and projected cumulative (20 years) noise levels in terms of L_{dn} or CNEL and/or the standards of Table [8-5], and compare those levels to the adopted policies of the Noise Element.
E.	Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element, giving preference to proper site planning and design over mitigation measures which require the construction of noise barriers or structural modifications to buildings which contain noise-sensitive land uses.
F.	Estimate noise exposure after the prescribed mitigation measures have been implemented.
G.	Describe a post-project assessment program which could be used to evaluate the effectiveness of the proposed mitigation measures.

Source: Shasta County 2004
Key:
CNEL = community noise equivalent level
L_{dn} = day-night noise level

- Where existing traffic noise levels are less than 60 dB Ldn, a +5 dB Ldn increase will be considered significant,
- Where existing traffic noise levels range between 60 and 65 dB Ldn, a +3 dB Ldn increase will be considered significant, and
- Where existing traffic noise levels are greater than 65 dB Ldn, a + 1.5 dB Ldn increase will be considered significant.

- **Policy N-i –** Where noise mitigation measures are required to achieve the standards of Tables 8-5 and 8-6, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving compliance with the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project.

- **Policy N-j –** Encourage railroad officials to install noise-mitigation features on trains, equipment, and at fixed-based facilities whenever possible, and instruct railroad engineers to limit their use of air horns to reduce rail-related noise impacts on cities, towns, and rural community centers.

- **Policy N-k –** All County airports lacking adopted noise level contours consistent with the General Plan forecast year of 2025 should update their respective Master Plans or Comprehensive Land Use Plans to reflect aircraft operation noise levels for existing and future operations.

- **Policy N-l –** The use of site planning and building materials/design as primary methods of noise attenuation is encouraged.

- **Policy N-m –** The County should adopt noise control guidelines to assist staff and project applicants in determining the appropriate methods for reducing transportation and non-transportation generated noise.

- **Policy N-n –** The State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code shall be enforced.

- **Policy N-o –** As the County updates the GIS mapping data base, the traffic, airport, and railroad noise contour information contained within the Background Report for the Noise Element shall be included as a part of the mapping data base. Noise contours for transportation and fixed noise sources should be periodically updated and any subsequent revisions of the data shall be incorporated into the General Plan and adopted for noise control planning purposes, as appropriate (see Tables 8-7 and 8-8).

Table 8-7. Maximum Allowable Noise Exposure Transportation Noise Sources

Land Use	Outdoor Activity Areas[a] L_{dn}/CNEL, dB	Interior Spaces	
		L_{dn}/CNEL, dB	L_{eq}, dB[b]
Residential	60 [c]	45	–
Transient Lodging	60 [d]	45	–
Hospitals, Nursing Homes	60 [c]	45	–
Theaters, Auditoriums, Music Halls	–	–	35
Churches, Meeting Halls	60 [c]	–	40
Office Buildings	–	–	45
Schools, Libraries, Museums	–	–	45
Playgrounds, Neighborhood Parks	70	–	–

Source: Shasta County 2004

Notes:

[a] Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use. Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.

[b] As determined for a typical worst-case hour during periods of use.

[c] Where it is not possible to reduce noise in outdoor activity areas to 60 dB Ldn/CNEL or less using a practical application of the best-available noise reduction measures, exterior noise levels of up to 65 dB Ldn/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

[d] In the case of hotel/motel facilities or other transient lodging, outdoor activity areas such as pool areas may not be included in the project design. In these cases, only the interior noise level criterion will apply.

Key:

CNEL = community noise equivalent level

dB = decibels

L_{dn} = day-night noise level

Table 8-8. Transportation Noise–Related Land Use Compatibility Guidelines for Development in Shasta County

Land Use Category	Community Noise Exposure (L_{dn} or CNEL, dB)							
		55	60	65	70	75	80	
Residential, Theaters, Music and Meeting Halls, Churches, and Auditoriums	G.A.	X	X					
	C.A.			X	X			
	G.U.					X	X	X
Transient Lodging— Motels, Hotels, and RV Parks	G.A.	X	X					
	C.A.			X	X	X		
	G.U.						X	X
Schools, Libraries, Museums, Nursing Homes, and Child Care	G.A.	X	X					
	C.A.			X	X	X		
	G.U.						X	X
Playgrounds, Neighborhood Parks, and Amphitheaters	G.A.	X	X	X	X			
	C.A.					X		
	G.U.						X	X
Office Buildings, Business, Commercial, and Professional	G.A.	X	X	X				
	C.A.				X	X		
	G.U.						X	X
Industrial, Manufacturing, Agriculture, and Utilities	G.A.	X	X	X	X			
	C.A.					X	X	X
	G.U.							
Golf Courses, Outdoor Spectator Sports, and Riding Stables	G.A.	X	X	X	X			
	C.A.					X	X	
	G.U.							X

Source: Shasta County 2004

Notes:

G.A. = Generally Acceptable. Specified land use is satisfactory. No noise mitigation measures are required.

C.A. = Conditionally Acceptable. Use should be permitted only after careful study and inclusion of protective measures as needed to satisfy the policies of the Noise Element.

G.U. = Generally Unacceptable. Development is usually not feasible in accordance with the goals of the Noise Element.

Key:

CNEL = community noise equivalent level

dB = decibels

L_{dn} = day-night noise level

Shasta County Code The Shasta County Code has one provision related to noise:

> 13.04.170: Unnecessary Noise Prohibited. No person shall operate any aircraft in flight or on the ground in such a manner as to cause unnecessary noise as determined by applicable Federal or State or local laws and regulations. (Prior code Section 2112.)

Tehama County

Tehama County General Plan The Noise Element of the *Tehama County General Plan* provides a basis for comprehensive local policies to control and abate environmental noise and to protect the citizens of the county from excessive noise exposure (Tehama County 2009). The fundamental goals of the Noise Element are as follows:

- **Goal N-1 –** Provide sufficient information concerning the community noise environment so that noise may be effectively considered in the land use planning process.
  - **Policy N-1.1 –** The County shall require an acoustical analysis for new projects anticipated to generate excessive noise located adjacent, or near, to noise-sensitive land uses. The acoustical analysis shall be prepared in accordance with Table 8-9, Requirements for Acoustical Analysis Prepared in Tehama County.

Table 8-9. Requirements for an Acoustical Analysis Prepared In Tehama County

An acoustical analysis prepared pursuant to the Noise Element shall:
(1) Be the responsibility of the applicant.
(2) Be prepared by qualified persons experienced in the fields of environmental noise assessment and architectural acoustics.
(3) Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions.
(4) Estimate existing and projected cumulative noise levels in terms of the standards of Tables 9-6 and 9-7 of this General Plan and compare those levels to the adopted policies of the Noise Element.
(5) Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element. Where the noise source in question consists of intermittent single events, the report must address the effects of maximum noise levels in sleeping rooms evaluating possible sleep disturbance.
(6) Estimate interior and exterior noise exposure after the prescribed mitigation measures have been implemented.
(7) Describe the post-project assessment program that could be used to evaluate the effectiveness of the proposed mitigation measures.

Source: Tehama County 2009

- **Goal N-2 –** Develop strategies for abating excessive noise exposure through cost-effective mitigation measures in combination with appropriate zoning to avoid incompatible land uses.
  - **Policy N-2.4 –** The County shall restrict construction activities to the hours as determined in the Countywide Noise Control Ordinance, if such an Ordinance is adopted.
    - **Implementation Measure N-2.4a –** Restrict construction activities to the hours as determined by the County's Noise Control Ordinance unless an exemption is received from the County to cover special circumstances. Special circumstances

may include emergency operations, short-duration construction, etc.

- **Implementation Measure N-2.4b –** Require all internal combustion engines that are used in conjunction with construction activities be muffled according to the equipment manufacturer's requirements.

- **Goal N-3 –** Protect those existing regions of the planning area whose noise environments are deemed acceptable, and also those locations throughout the community deemed "noise sensitive."

- **Goal N-4 –** Protect existing noise-producing commercial and industrial uses in Tehama County from encroachment by noise-sensitive land uses.

  - **Policy N-4.1 –** The County shall require review for discretionary industrial, commercial, or other noise-generating land uses for compatibility with adjacent and nearby noise-sensitive land uses.

  - **Policy N-4.2 –** The interior and exterior noise level standards for noise-sensitive areas of new uses affected by non-transportation noise sources within Tehama County are depicted in Table 8-10.

Lower Sacramento River and Delta

General plan noise elements and noise ordinances from all counties in the lower Sacramento River and Delta and communities in Tehama, Butte, Glenn, Colusa, Sutter, Yolo, Sacramento, Solano, and Contra Costa counties would be applicable to affected areas within their jurisdictions. The general plans and codes in these jurisdictions would be similar to the Shasta and Tehama county regulations outlined above. Construction, land use, and acceptable levels for various land uses would be defined and outlined.

CVP/SWP Service Areas

All community and county plans and ordinances in the CVP and SWP service areas would be applicable to affected areas within their jurisdictions. The general plans and codes in these jurisdictions would be similar to the Shasta and Tehama county regulations outlined above. Construction, land use, and acceptable levels for various land uses would be defined and outlined.

Table 8-10. Noise Standards for New Uses Affected By Nontransportation Noise in Tehama County

New Land Use	Outdoor Activity Area—L_{eq}, dB		Interior—L_{eq}, dB	
	Daytime	Nighttime	Day and Night	Notes
All Residential	50	45	35	1,2,7
Transient Lodging	55	–	40	3
Hospitals and Nursing Homes	50	45	35	4
Theaters and Auditoriums	–	–	35	
Churches, Meeting Halls, Schools, Libraries, etc.	55	–	40	
Office Buildings	55	–	45	5,6
Commercial Buildings	55	–	45	5,6
Playgrounds, Parks, etc.	65	–	–	6
Industry	65	65	50	5

Source: Tehama County 2009

Notes:

[1] Outdoor activity areas for single-family residential uses are defined as back yards. For large parcels or residences with no clearly defined outdoor activity area, the standard shall be applicable within a 100-foot radius of the residence.

[2] For multi-family residential uses, the exterior noise level standard shall be applied at the common outdoor recreation area, such as at pools, play areas or tennis courts. Where such areas are not provided, the standards shall be applied at individual patios and balconies of the development.

[3] Outdoor activity areas of transient lodging facilities include swimming pool and picnic areas, and are not commonly used during nighttime hours.

[4] Hospitals are often noise generating uses. The exterior noise level standards for hospitals are applicable only at clearly identified areas designated for outdoor relaxation by either hospital staff or patients.

[5] Only the exterior spaces of these uses designated for employee or customer relaxation have any degree of sensitivity to noise.

[6] The outdoor activity areas of office, commercial and park uses are not typically utilized during nighttime hours.

[7] It may not be possible to achieve compliance with this standard at residential uses located immediately adjacent to loading dock areas of commercial uses while trucks are unloading. The daytime and nighttime noise level standards applicable to loading docks shall be 55 and 50 dB Leq, respectively.

General: The Table 9-7 standards shall be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards of Table 9-7, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.

Key:
dB = decibels
L_{eq} = equivalent noise level

8.3 Environmental Consequences and Mitigation Measures

8.3.1 Methods and Assumptions

Land use types and major noise sources in the project vicinity were identified based on existing documentation (e.g., the Shasta County Zoning Code) and site reconnaissance data. To assess potential short-term construction noise impacts, sensitive receptors and their relative exposure (considering topographic barriers and distance) were identified. Noise levels of specific construction equipment were determined and resultant noise levels at those receptors were calculated.

Potential long-term (operational) traffic, area-source, and stationary-source noise impacts were qualitatively assessed based on the number of vehicle trips and other potential operational noise sources introduced to the project area.

Groundborne vibration impacts were qualitatively assessed based on existing documentation (e.g., vibration levels produced by specific construction equipment) and the distance of sensitive receptors from the given source.

Predicted noise levels were compared with applicable standards for determination of significance. Mitigation measures were developed for significant and potentially significant noise impacts.

8.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. Under NEPA, the significance of an effect is used solely to determine whether an environmental impact statement must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A "[s]ignificant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

The following significance criteria were developed based on guidance provided by the State CEQA Guidelines, other Federal, State, and local guidance, and consider the context and intensity of the environmental effects as required under NEPA. Impacts of an alternative on noise would be significant if project implementation would do any of the following:

- Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Expose persons to or generate excessive groundborne vibration or groundborne noise levels.
- Permanently increase ambient noise levels in the project vicinity substantially above levels existing without the project.

- Temporarily or periodically increase ambient noise levels in the project vicinity substantially above levels existing without the project.
- Expose people residing or working in the project area to excessive aircraft-generated noise levels.

8.3.3 Topics Eliminated from Further Consideration

None of the project alternatives would expose people residing or working in the project area to excessive aircraft-generated noise levels because of the distance of existing airports to the project area. There would also be no change in railway traffic as a result of any of the alternatives. Therefore, potential effects on the primary and extended study areas related to these issues are not discussed further in this PDEIS.

This analysis assumes that the operation of any of the project alternatives would not generate any new significant long-term noise sources because operation and maintenance of Shasta Dam and current or relocated recreational facilities would be relatively unchanged compared to existing conditions. Relocated recreational facilities would presumably generate the same levels and types of noise, but in a slightly different location than currently exists. After completion of the dam raise, bridge and levee construction, and relocation of recreational facilities, the number of personnel serving at all sites during construction would be reduced to approximately the number currently serving to operate and maintain the facilities. Therefore, no further analysis is needed and no mitigation would be needed.

No effects on the current ambient noise environment would occur in the lower Sacramento River and Delta and the CVP and SWP service areas; no construction activities would occur in these geographic regions, and there would be no long-term noise sources from dam operation, modified flows in the Sacramento River and other tributaries, or water storage and conveyance throughout the CVP and SWP service areas. Therefore, potential effects related to project noise in those geographic regions are not discussed further in this PDEIS.

8.3.4 Direct and Indirect Effects

No-Action Alternative

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (No-Action): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise No construction activities would occur and current operations would continue. Recreational use, population, and traffic would all increase but these increases and the effect on the noise environment would not be substantial. This impact would be less than significant.

No construction activities would occur and the dam would continue to function as it currently functions. Because no construction activities would occur under this alternative, implementing the No-Action Alternative could not contribute toward a temporary change in the ambient noise environment. Generally, ambient noise levels would likely increase under the No-Action Alternative because greater recreational use, population growth, and traffic would occur; however, these increases would not be substantial. As a result, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact Noise-2 (No-Action): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction No construction activities would occur and current operations would continue. Recreational use, population, and traffic would all increase, but these increases and the effect on the noise environment would not be substantial. This impact would be less than significant.

This impact is similar to Impact Noise-1 (No-Action) for the primary study area. For the same reasons as described under Impact Noise-1 (No-Action), this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact Noise-3 (CP1): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations No construction activities would occur and current operations would continue. Recreational use, population, and traffic would all increase, but these increases and the effect on the noise environment would not be substantial. This impact would be less than significant.

This impact is similar to Impact Noise-1 (No-Action) for the primary study area. For the same reasons as described under Impact Noise-1 (No-Action), this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Lower Sacramento River and Delta and CVP/SWP Service Areas No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects in those geographic regions are not discussed further in this PDEIS.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (CP1): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree removal, material handling, demolition, and site restoration and cleanup. Increases in truck traffic from construction would not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. This temporary impact would be significant.

Construction activities at the Shasta Dam site under CP1 would include site preparation (e.g., excavation, grading, and clearing), the proposed dam raise, blasting, tree removal, material handling, site restoration and clean-up, and other miscellaneous activities. Temporary noise effects of the operation of heavy-duty construction equipment at the dam, blasting activities, operation of heavy-duty construction equipment at other project sites, and off-site construction traffic are addressed separately below.

Operation of Heavy-Duty Construction Equipment at the Dam The construction activities mentioned above would require the use of scrapers, excavators, bulldozers, compactors, loaders, trucks, crushers, pumps, pavers, concrete mixers, cranes, generators, and other miscellaneous pieces of equipment based on similar projects. According to the U.S. Environmental Protection Agency, noise levels generated by individual pieces of these types of equipment can range from 76 to 94 dBA at 50 feet without feasible noise control (Table 8-11). Simultaneous operation of the heavy-duty construction equipment could result in combined intermittent noise levels of approximately 94 dBA at 50 feet from the project site. Based on these noise levels and a typical noise-attenuation rate of 6.0 dBA/DD, exterior noise levels at noise-sensitive receptors located within 4,000 feet of construction activity could exceed 55 dBA L_{eq} (the Shasta County standard for daytime hours) without noise control. However, there is a 450-foot elevation increase spanning 4,500 feet of intervening topography between the nearest receptors (residences on Lake Boulevard) and Shasta Dam. Accounting for the intervening topography attenuation, the vegetation, and the distance between the dam and receptors, an attenuation rate of approximately -100 dBA can be applied (-40 dBA for distance, -10 dBA for trees and vegetation, and -50 dBA for topographic elevation change). Thus, noise levels at the nearest sensitive receptor would be less than 50 dBA L_{dn}.

Additional residential receptors are approximately 7,000 feet down the Sacramento River from Shasta Dam. The construction-related noise level at this location would be approximately 45 dBA (95 dBA at 50 feet from construction site minus 45 dBA attenuation for distance, and minus 5 dBA attenuation from vegetation and topography). Thus, project construction noise generated by on-site construction equipment at Shasta Dam under CP1 would not expose sensitive receptors to or generate noise levels in excess of applicable standards (55 dBA daytime, 50 dBA nighttime), or to a substantial temporary increase in noise levels above existing conditions. This temporary impact would be less than significant.

Blasting Activities at the Dam Construction of the Shasta Dam height increase would require blasting during excavation of rock for the concrete tie-in to adjacent rock. Specific blast design parameters such as explosive type and amount (charge weight), drill pattern, and time scheme are not known at this time. However, it is anticipated that few blasts would occur each day. Blasting operations would result in airborne noise caused by the energy released in the explosion, which creates an air overpressure (airblast) in the form of a propagating wave. Still, as currently planned, single-event noise levels could exceed 110 dBA (FTA 2006). Based on the above attenuation rates, construction noise from project-related blasting activities could result in noise levels of 60 dBA at sensitive receptors downstream along the Sacramento River (7,000 feet away). As a result, the temporary impact of single-event increases in noise levels would be significant.

Operation of Heavy-Duty Construction Equipment at Other Project Sites Multiple construction activities would occur at the other project-related sites (Pit River Bridge, the lakeshore area, and other areas where bridges and roads would require relocation; recreation facilities that would require removal and reconstruction; and inundation areas that would require clearing). Among the anticipated construction activities are site preparation (e.g., excavation, grading, demolition, and clearing), paving, pile driving, laying of railroad tracks, bridge relocation, removal of trees and vegetation, material handling, and site restoration and cleanup.

Based on similar projects, the on-site construction equipment required for the activities would likely include but not be limited to an excavator, bulldozer, front-end loader, grader, compactor, cranes, pile drivers, trucks, and other large pieces of equipment as necessary. According to the U.S. Environmental Protection Agency, noise levels from individual pieces of these types of equipment, when operated without feasible noise control, can range from 79 to 96 dBA at 50 feet (Table 8-11). Simultaneous operation of the three noisiest pieces of heavy-duty construction equipment, including pile driving, could result in combined intermittent noise levels of approximately 97 dBA at 50 feet from the project site. Based on these noise levels and a typical noise-attenuation rate of 6.0 dBA/DD, exterior noise levels at noise-sensitive receptors located within 75 feet of construction activity (i.e., sensitive receptors along Lakeshore Drive) could exceed 94 dBA L_{eq} without noise control. Such noise levels would exceed Shasta County standards (55 dBA daytime, 50 dBA nighttime).

Table 8-11. Typical Construction Equipment Noise Levels

Type of Equipment	Noise Level at 50 feet (dBA)
Scraper	89
Excavator	89
Bulldozer	85
Compactor	82
Loader	85
Truck	88
Crusher	94
Pump	76
Paver	89
Concrete Pump	82
Concrete Mixer	85
Derrick Crane	88
Pile Driving (sonic)	96
Generator	81

Source: FTA 2006

Key:
dBA = A-weighted decibels

Helicopters would be used for vegetation removal during the spring and fall, when helicopters are not in use for firefighting. Helicopter noise levels range from 80 to 90 dBA at 250 feet (Caltrans 2002b). Noise levels from helicopters would be similar to those of other construction equipment described above.

Construction in areas away from the dam site would occur primarily during the daytime; however, the exact hours of construction are not specified at this time, nor has Shasta County adopted a noise ordinance that exempts construction noise from the provisions of the standard. If construction activities were to occur during the more noise-sensitive hours (evening, nighttime, and early morning), or if equipment were not properly equipped with noise-control devices, construction noise could exceed applicable noise-level standards (i.e., Shasta County's nighttime standard of 50 dBA L_{eq}) at existing noise-sensitive receptors located within 7,000 feet. In addition, any project-related construction noise generated during these more noise-sensitive hours may annoy and/or disrupt the sleep of occupants of the nearby existing noise-sensitive land uses, and temporarily but substantially increase ambient noise levels in the project vicinity. As a result, this impact would be significant.

Off-Site Construction Traffic Project construction would require approximately 350 on-site employees at any given time. Assuming two total trips per day per employee and 81 round trips per day for the transport of equipment and materials, project construction would result in a maximum of approximately 862 one-way daily trips at the dam site. Typically, traffic volumes must double before the associated increase in noise levels is noticeable (3 dBA CNEL/L_{dn}) along roadways. Given that the average daily traffic volumes are 5,500 for State Route 151, 37,000 for I-5, and 2,000 for the Lakeshore Community, traffic would not double. Therefore, adding these daily trips on the local roadway system to existing volumes would be a minor change. Consequently, project construction under CP1 would not noticeably change the traffic-noise contours of area roadways. This impact would be less than significant.

Summary Implementing CP1 would result in less than significant noise impacts related to operation of heavy-duty construction equipment at Shasta Dam and off-site construction traffic. However, the impact of this alternative related to blasting activities at Shasta Dam and operation of heavy-duty construction equipment at other project sites would be significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-2 (CP1): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. As a result, this temporary impact would be less than significant.

According to FTA, vibration levels associated with the use of trucks, dozers, and other heavy-duty construction equipment such as the equipment types used at project construction sites are 0.076 to 0.089 in/sec PPV and 86–87 VdB at 25 feet, and vibration levels from pile driving can reach 0.73 in/sec PPV (Table 8-10). Vibration levels generated during project construction under CP1 could exceed Caltrans's recommended standard with respect to the prevention of structural damage (0.2 in/sec PPV for buildings) and FTA's maximum-acceptable constant vibration standard of 80 VdB with respect to human annoyance for residential uses within 65 feet of the impact zone. Because there are no sensitive receptors within these distances from any of the construction sites (the nearest residences would be along Lakeshore Drive and approximately 75 feet from road and bridge construction activities taking place in the area), implementing CP1 would not generate excessive groundborne vibration or groundborne noise levels, nor would it expose persons or buildings to such groundborne vibration or noise. As a result, this temporary impact would be less than significant.

Blasting at the Shasta Dam site would result in ground vibration from the creation of seismic waves that radiate along the earth's surface. As discussed previously, no noise-sensitive receptors are located near the dam site. Receptors would need to be within 250 feet of the blasts to be affected (greater than 80 VdB) by groundborne vibration. No sensitive receptors are within this range of the dam. Therefore, this temporary impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP1): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic noise create a substantial increase in ambient noise levels in the project vicinity. As a result, this impact would be less than significant.

Relocating Lakeshore Drive would move traffic noise closer to sensitive receptors in the Lakeshore Community. Based on roads of this size and service, it is estimated that the maximum average daily traffic in this area would be approximately 2,000 vehicles per day. Modeling by the Federal Highway Administration for a 2,000-average daily traffic two-lane roadway places the 60-dBA L_{dn} contour (Shasta County's transportation standard) at 70 feet from the roadway centerline. With the additional noise emanating from the adjacent railroad line (Shasta County 2004) and the nearest receptors farther than 75 feet from the new roadway centerline, the ambient noise level would not increase by more than 3 dBA or exceed 60 dBA (Shasta County 2004). Thus, project-generated long-term traffic noise would not result in an exceedence of the Shasta County standards. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas
Implementing CP1 would not generate any new long-term noise outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP1 in those geographic regions are not discussed further in this PDEIS.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

The direct and indirect impacts of CP2 related to noise and vibration would be essentially the same as those described for CP1 because construction activities, and equipment and workforce needs, would be similar under both alternatives. Also, the long-term impact of CP2 on traffic levels associated with relocating Lakeshore Drive would be expected to be similar to the corresponding impact of CP1. Thus, as described below, the impacts described for CP1 would generally also apply to CP2.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)
Impact Noise-1 (CP2): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree

removal, material handling, demolition, and site restoration and cleanup. Increases in truck traffic from construction would not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. This temporary impact would be significant.

This impact would be the same as Impact Noise-1 (CP1) and would be significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-2 (CP2): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-2 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP2): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic create a substantial increase in ambient noise levels in the project vicinity. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-3 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas Similar to CP1, implementing CP2 would not generate any new long-term noise outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP2 in those geographic regions are not discussed further in this PDEIS.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply

The direct and indirect impacts of CP3 related to noise and vibration would be essentially the same as those described for CP1 and CP2 because construction activities, and equipment and workforce needs, would be similar under these alternatives. Also, the long-term impact of CP3 on traffic levels associated with relocating Lakeshore Drive would be expected to be similar to the corresponding impact of CP1 and CP2. Thus, as described below, the impacts described for CP1 and CP2 would generally also apply to CP3.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (CP3): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree removal, material handling, demolition, and site restoration and cleanup. Increases in truck traffic from construction would not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. This temporary impact would be significant.

This impact would be the same as Impact Noise-1 (CP1) and would be significant.

Impact Noise-2 (CP3): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-2 (CP1) and would be less than significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-3 (CP3): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic create a substantial increase in ambient noise levels in the project vicinity. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-3 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas Similar to CP1 and CP2, implementing CP3 would not generate any new long-term noise outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP3 in those geographic regions are not discussed further in this PDEIS.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus With Water Supply Reliability

The direct and indirect impacts of CP4 related to noise and vibration would be essentially the same as those described for CP1 through CP3 because construction activities, and equipment and workforce needs, would be similar under these alternatives. Also, the long-term impact of CP4 on traffic levels associated with relocating Lakeshore Drive would be expected to be similar to the corresponding impact of CP1 and CP2. Thus, as described below, the impacts described for CP1 and CP2 would generally also apply to CP4.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (CP4): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise levels would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree removal, material handling, demolition, and site restoration and cleanup. Increases in truck traffic from construction would not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. Gravel augmentation under CP4 would increase the total number of construction-related truck trips, but not enough to result in a violation of traffic noise standards or a substantial increase in traffic noise. This temporary impact would be significant.

This impact would be similar to Impact Noise-1 (CP1), but slightly greater because of the addition of gravel augmentation along the upper Sacramento River that is proposed under CP4. The proposed gravel augmentation would result in approximately 800 truck trips per year. Assuming 44 work days, approximately 18 truck trips per day would be added to the local roadway network. In addition, the Reading Island restoration project component would also be included under CP4. Reading Island restoration construction would include an excavator, loader, and compaction equipment. Noise levels would be similar to those described under CP1 and CP2 (see Table 8-11). Approximately 350 haul trips would be needed to remove material from the site, resulting in approximately eight trips per day over a 2-month period. As discussed above under Impact Noise-1 (CP1), to generate a substantial increase in traffic noise, the traffic volume must double. Because adding 26 truck trips would not double roadway traffic volumes, no violation of traffic noise standards or substantial increase in traffic noise would occur. For the same reasons as described for Impact Noise-1 (CP1), this impact would be significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-2 (CP4): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-2 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP4): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic create a substantial increase in ambient noise levels in the project vicinity. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-3 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas Similar to CP1, implementing CP4 would not generate any new long-term noise sources outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP4 in those geographic regions are not discussed further in this PDEIS.

CP5 – 18.5-Foot Dam Raise, Combination Plan

The direct and indirect impacts of CP5 related to noise and vibration would be essentially the same as those described for CP1 through CP4 because construction activities, and equipment and workforce needs, would be similar under these alternatives. Also, the long-term impact of CP5 on traffic levels associated with relocating Lakeshore Drive would be expected to be similar to the corresponding impact under CP1 and CP2. Thus, as described below, the impacts described for CP1 and CP2 would generally also apply to CP5.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (CP5): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise levels would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree removal, material handling, demolition, and site restoration and cleanup. Increases in truck traffic from construction would not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. Gravel augmentation under CP5 would increase the total number of construction-related truck trips, but not enough to result in a violation of traffic noise standards or a substantial increase in traffic noise. This temporary impact would be significant.

Like CP4, CP5 would involve gravel augmentation along the upper Sacramento River and restoration at Reading Island, neither of which would occur under CP1, CP2, or CP3. Reading Island restoration construction would include an excavator, loader, and compaction equipment. Noise levels would be similar to those described under CP1 and CP2 (see Table 8-11). Approximately 350 haul trips would be needed to remove material from the site, resulting in approximately eight trips per day over a 2-month period. As discussed above under Impact Noise-1(CP1), to generate a substantial increase in traffic noise, a doubling of traffic volume would be required. Because adding 26 truck trips would not double roadway traffic volumes, no violation of traffic noise standards or substantial increase in traffic noise would occur. Noise levels from construction equipment, however, would still likely exceed noise standards. Therefore, temporary, construction-related impacts would be significant.

Thus, this impact would be the same as Impact Noise-1 (CP4) and would be significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-2 (CP5): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. The additional habitat development included in CP5 would occur in uninhabited areas of Shasta-Trinity National Forest, would not affect sensitive receptors, and would be temporary. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-2 (CP1). CP5 would also involve development of additional habitat; however, habitat development would occur in an uninhabited area managed by the U.S. Bureau of Land Management, would not be expected to affect any sensitive receptors, and would be temporary. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP5): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic create a substantial increase in ambient noise levels in the project vicinity. The additional habitat development included in CP5 would occur in uninhabited areas of Shasta-Trinity National Forest, would not create new operational traffic, and would not affect sensitive receptors. This impact would be less than significant.

This impact would be the same as Impact Noise-3 (CP1). CP5 would also involve development of additional habitat; however, habitat development would occur in an uninhabited area managed by the U.S. Bureau of Land Management, would not create any new operational traffic, and is not expected to affect any sensitive receptors. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas Similar to CP1 and CP2, implementing CP5 would not generate any new long-term noise outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP5 in those geographic regions are not discussed further in this **P**DEIS.

8.3.5 Mitigation Measures

Table 8-12 presents a summary of mitigation measures for noise and vibration.

Table 8-12. Summary of Mitigation Measures for Noise and Vibration

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact Noise-1: Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise	LOS before Mitigation	LTS	S	S	S	S	S
	Mitigation Measure	None required.	Mitigation Measure Noise-1: Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Noise-2: Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Noise-3: Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Key:
LOS = level of significance
LTS = less than significant
S = significant

No-Action Alternative

No mitigation measures are needed for this alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts Noise-2 (CP1) and Noise-3 (CP1). Mitigation is provided below for the remaining noise impact of CP1.

Mitigation Measure Noise-1 (CP1): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites Reclamation and its primary construction contractors will implement the measures listed below during construction:

- Construction activities at non-dam sites will be limited to the less noise-sensitive daytime hours (7 a.m. to 10 p.m., Monday through Friday).
- All construction equipment and staging areas will be located at the farthest distance possible from nearby noise-sensitive land uses.
- All construction equipment will be properly maintained and equipped with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations. Equipment engine shrouds will be closed during equipment operation.
- All motorized construction equipment will be shut down when not in use to prevent idling.
- A temporary barrier will be placed as close to the noise source or receptor as possible and will break the line of sight between the source and receptor.
- A disturbance coordinator will be designated and the person's telephone number conspicuously posted around the project sites and supplied to nearby residences. The disturbance coordinator will receive all public complaints and be responsible for determining the cause of the complaint and implementing any feasible measures to alleviate the problem.

Implementation of this mitigation measure would reduce temporary project-generated construction source noise levels and limit them to the less sensitive daytime hours, thus preventing exposure of sensitive receptors to temporary construction noise at dam and non-dam sites. As a result, Impact Noise-1 (CP1) would be reduced to a less than significant level.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts Noise-2 (CP2) and Noise-3 (CP2). Mitigation is provided below for the remaining noise impact of CP2.

Mitigation Measure Noise-1 (CP2): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites This mitigation measure is identical to Mitigation Measure Noise-1 (CP1). Implementation of this mitigation measure would reduce Impact Noise-1 (CP2) to a less than significant level.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply

No mitigation is needed for Impacts Noise-2 (CP3) and Noise-3 (CP3). Mitigation is provided below for the remaining noise impact of CP3.

Mitigation Measure Noise-1 (CP3): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites This mitigation measure is identical to Mitigation Measure Noise-1 (CP1). Implementation of this mitigation measure would reduce Impact Noise-1 (CP3) to a less than significant level.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus With Water Supply Reliability

No mitigation is needed for Impacts Noise-2 (CP4) and Noise-3 (CP4). Mitigation is provided below for the remaining noise impact of CP4.

Mitigation Measure Noise-1 (CP4): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites This mitigation measure is identical to Mitigation Measure Noise-1 (CP1). Implementation of this mitigation measure would reduce Impact Noise-1 (CP4) to a less than significant level.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation is needed for Impacts Noise-2 (CP5) and Noise-3 (CP5). Mitigation is provided below for the remaining noise impact of CP5.

Mitigation Measure Noise-1 (CP5): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites This mitigation measure is identical to Mitigation Measure Noise-1 (CP1). Implementation of this mitigation measure would reduce Impact Noise-1 (CP5) to a less than significant level.

8.3.6 Cumulative Effects

Past and present projects from areas within Shasta and Tehama counties affect noise conditions in the primary study area through the use of heavy construction equipment and the increase in traffic resulting from construction activities. Other stationary sources (e.g., railroads, traffic on existing highways) also contribute to ambient noise in the primary study area. In many cases, other related projects could create substantially more noise than the project, and would result in a cumulatively significant noise impact.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Projects that could influence ambient noise levels in areas where the SLWRI could contribute noise include the *Shasta-Trinity National Forest Land and Resource Management Plan, Iron Mountain Mine Restoration Plan, and Mendocino National Forest Land and Resource Management Plan; development of the Turntable Bay Master Development Plan*; and construction of the Antlers Bridge replacement. If the listed projects were to occur concurrently with any of the project alternatives under the SLWRI (CP1–CP5), combined noise generation during construction would be unlikely to be substantial because noise is generally a local phenomenon and is minimal beyond 0.5 mile. Noise from the SLWRI would not combine with other noise sources, such as construction from the projects listed above. After project construction is completed, the ambient noise environment relative to Shasta Dam would return to existing conditions. Therefore, none of the project alternatives would make a cumulatively considerable incremental contribution to cumulative noise effects.

Lower Sacramento and Delta and CVP/SWP Service Areas

Raising Shasta Dam would not result in any short-term or long-term effects on the ambient noise environment in the extended study area under any of the project alternatives. Therefore, there would be no cumulatively considerable incremental contribution to cumulative noise effects under any of the project alternatives.